



# Inspection

Vehicle-Tank Meters  
NIST Short Course



# Inspection - General

- ◆ Facilitation of Fraud (G-S.2)
  - design, installation, assembly will not facilitate fraud
- ◆ Selection (Permanence, G-S.3.)
  - materials, design, & construction to maintain accuracy, operation, adjustments
- ◆ Suitability of Equipment (G-UR.1.1)
  - flow rate, smallest unit, size and location of indicating element



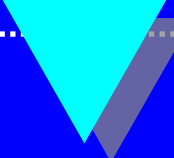
# Inspection - General

- ◆ Suitability - LMDs (G-UR.1.3)
  - minimum delivery not less than 100 divisions
  - 10 divisions for analog devices
- ◆ Environment (G-UR.1.2)
  - suitable for environment in which device is used
  - effects of environment such as wind, RFI, etc.




# Inspection - General

- ◆ Assistance (G-UR.4.4.)
  - owner must supply any special equipment, accessories, or additional labor if device design or location requires
- ◆ Testing at a Central Location (G-UR.4.6.a.)
  - official can require devices at central location
- ◆ Method of Operation (G-UR.3.1.)
  - operation must be consistent with intended design



# Inspection - General

- ◆ Maintenance of Equipment (G-UR.4.1.)
  - equipment maintained in proper condition
  - errors can not predominantly favor owner
    - ◆ can reject all devices at single location even if within tolerance
    - ◆ some jurisdictions have specific policies
- ◆ Abnormal Performance (G-UR.4.2.)
  - abnormal performance brought to owner's attention
- ◆ Ticket in Printing Device (UR.2.3.)
  - ticket in device immediately before delivery
  - ticket can not be in device while on public road



# Inspection - General

- ◆ Position of Equipment (G-UR.3.3.)
  - indications and measuring operation observable by customer from reasonable location
- ◆ Accessibility (G-UR.2.3)
  - device and installation accessible for inspection, testing, sealing, test equipment
  - responsibility of owner to supply special facilities or labor
- ◆ Installation (G-UR.2.1.)
  - in accordance with manufacturer's instructions
  - installation does not interfere with operation



# Installation

- ◆ Installation of Indicating & Recording Elements (G-UR.2.2.)
  - no obstruction between primary indicating/recording element and measuring element
    - ◆ otherwise means for oral or visual communication provided
- ◆ Discharge Rate (UR.1.1.)
  - actual maximum discharge rate shall not exceed rated
    - ◆ flow regulation incorporated if necessary
      - automatic in nature



# Marking

## ◆ Identification (G-S.1.)

- name, initials, trademark of mfg or distributor
- model designation
- serial number (NR as of 1968)
- terms identifying model and serial numbers (NR as of 1986/2003/2001)
- NTEP Certificate of Conformance Number (NR as of 2003)
- information readily observable without disassembly

## ◆ Visibility of Identification (G-UR.2.1.1.)

- installation such that required markings are visible





# Marking (cont.)

## ◆ Limitation of Use (S.5.1.)

- meter intended to measure specific products
- meter intended to operate only under specific conditions or with specific equipment

## ◆ Discharge Rates (S.5.2.)

- maximum and minimum
- minimum shall not exceed 20 percent of maximum



# Indicating & Recording Elements

- ◆ General (S.1.1.1.)
  - indicator required; printer on all but aircraft VTM
- ◆ Units (S.1.1.2.(a))
  - indications in terms of gallons or liters
- ◆ Indicating & Recording Elements (G-S.5.)
  - appropriate, clear, definite
- ◆ Marking Operational Controls, Indications & Features (G-S.6.)
  - clearly identified; approved pictograms acceptable



# Indicating & Rec. Elements (cont.)

- ◆ Lettering (G-S.7.)
  - lettering easily read and will not tend to become illegible
- ◆ Graduations (S.1.2.)
  - length, width, clear interval
- ◆ Indicators (S.1.3.)
  - symmetry, length, width, clearance, parallax
  - width of indicator not greater than width of narrowest graduation (NR 2002)
- ◆ Values of Graduated Intervals/Increments (G-S.5.3.)
  - increments uniform throughout series



# Indicating & Rec. Elements (cont.)

- ◆ Advancement of Elements (S.1.1.4.)
  - advancement only by mechanical operation
  - advance to zero allowed:
    - ◆ once started cannot stop
    - ◆ indications are obscured during re-zero
- ◆ Return to Zero (S.1.1.5.) & (UR.2.1.)
  - means to return indications to zero
  - return indications to zero before each delivery



# Indicating & Rec. Elements (cont.)

## ◆ Provision for Sealing (G-S.8.)

- security seal or audit trail

## ◆ Security Seal (G-UR.4.5.)

- security seal affixed to mechanisms designed to be sealed



# Computing-Type Devices

- ◆ Display of Unit Price (S.1.4.1.)
  - means to display unit price on outside of device
- ◆ Unit Price (UR.1.2.)
  - unit price displayed on outside of device
- ◆ Printed Ticket (S.1.4.2.)
  - if ticket shows total price, quantity and unit price must also be shown



# Computing-Type Devices

- ◆ Money-value Computations (S.1.4.3.)
  - value of increment is 1 cent
- ◆ Money-value Mathematical Agreement (S.1.4.4.)
  - digital in agreement with analog to within 1 cent
- ◆ Ticket Printer, Customer Ticket (UR.2.2.)
  - ticket printer required
    - ◆ used for all sales
    - ◆ copy of ticket to customer unless otherwise specified by customer
  - exceptions for Aviation Fuel (UR.2.2.1.)



# Measuring Elements

- ◆ Vapor Elimination (S.2.1.)
  - effective means to prevent passage of vapor/air
  - vent lines of metal tubing or rigid material
- ◆ Provision for Security Seal (S.2.2.)
  - provision to apply seal to adjustments
- ◆ Security Seal (G-UR.4.5.)
  - seal affixed to element designed to be sealed





# Piping

- ◆ Directional Flow Valve (S.2.3.)
  - valves to prevent reverse flow automatic
- ◆ Design of Discharge Lines & Valves (S.3.)
  - Diversion of Measured Flow (S.3.1.)
    - ◆ no means to divert product
    - ◆ two outlets permitted if:
      - liquid can flow from only one outlet at a time
      - direction of flow clearly marked
  - Pump-Discharge Unit (S.3.2.)
    - ◆ wet-hose -- shutoff at outlet end
    - ◆ dry-hose -- short as practicable



# Piping (cont.)

- ◆ Discharge Hose (S.3.4.)
  - adequately reinforced
- ◆ Discharge Valve (S.3.5.)
  - valve in discharge line allowed if wet-hose type
    - ◆ preset valve allowed
- ◆ Antidrain Valve (S.3.6.)
  - valve to prevent drainage of discharge hose